IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT OPERATIONS

Art Unit: 1742 (Examiner: McNelis, Kathleen A)

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Serial No: 10/789,694

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Title: COMBINED PRE-TREATMENT PROCESS FOR ENABLING FEED MATERIAL TO BE CHARGED IN DIRECT REDUCTION PROCESS

Charlotte, North Carolina
August 23, 2006

Honorable Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AND RESPONSE

Dear Sir:

In response to the final Office Action mailed August 9, 2006 and the Interview Summary faxed August 16, 2006 Applicants submit the following amendments and remarks. Accordingly, reconsideration and allowance of the present application are respectfully requested.

Please amend the claims to read as follows:

1. (Currently Amended) A pretreatment process for solid sedimentary iron ore lump feed material for a direct reduction processes to reduce the formation of fines, comprising:

storing solid lump feed material ~~in a stockpile~~ for a predetermined time of at least one month in an open atmosphere, therein providing time to release ~~releasing~~ internal stresses of the sedimentary lump ore;

reclaiming the solid lump feed material stored for at least one month; and

pre-drying the solid lump feed material to a temperature less than 200° C and to a water content less than about 0.5% by weight prior to charging the feed material to a gas-based direct reduction furnace.

2. (Cancelled)

3. (Cancelled)

4. (Previously Presented) A process according to claim 1, wherein said pre-drying is accomplished in a feed storage bin by introduction of waste off-gases.

5. (Previously Presented) A process according to claim 4, wherein the waste off-gas temperature is in excess of 300° C upon introduction into the feed storage bin.

6. (Original) A process according to claim 4, wherein said waste off-gases are removed from a reformer associated with the direct reduction process.

7. (Currently Amended) Apparatus for pre-drying lump iron ore and utilizing the pre-dried iron ore lump feed material, comprising:

means for storing sedimentary iron ore solid lump feed material for a predetermined time of at least one month in an open atmosphere;

means for reclaiming the solid lump feed material stored for at least one month;

means for pre-drying the solid lump feed material to a temperature less than 200° C and to a water content less than about 0.5% by weight;

a direct reduction shaft furnace having an upper feeding and heating portion, middle gas feeding and reducing portion, and a lower product discharge portion;

means for removing hot gas from the furnace;

reformer means for reforming removed off-gas, including means for heating the reformer by combustion of gas, and means for removing waste combusted off-gas from the reformer;

a feed material storage bin having communication with waste combusted off-gas, wherein said feed material storage bin is a heated and drying storage bin for lump iron ore until the feed material has a temperature greater than 150° C and less than 200° C, and a water content less than about 0.5% by weight; and

means for transporting the heated feed material to the furnace and for charging the heated feed material into the furnace for reduction.

8. (Original) Apparatus according to claim 7 wherein said feed storage bin is enclosed, and said means for transporting the heated feed material to the furnace is insulated.

9. (Previously Presented) A process according to claim 1 further comprising charging the pre-dried iron ore lump feed material into the furnace separately from any lime coated pellet feed material.

10. (Previously Presented) Apparatus according to claim 8, further comprising means for adjusting the temperature of the waste combusted off-gas between said means for removing waste combusted off-gas and said feed material storage bin.

REMARKS

Claims 1 and 4-10 are pending. Claims 2 and 3 are cancelled. Claims 1 and 7 are currently amended.

Claims 1-2 and 4-10 stand rejected under 35 U.S.C.103(a).

Claim 1 is currently amended to include the limitation of claim 2, and the step of "reclaiming the solid lump feed material stored for at least one month". The amendment is fully supported by the specification on page 8, lines 16-17. The specification reads that the stored lump ore feed is "reclaimed". The step of "reclaiming" taken with the step of "storing" is equivalent to stating that the claimed process is one where the inventory of ore is rotated, where the increment of rotation is a time period of "at least one month". The process is a type of inventory rotation that is not dissimilar from aging wine or whisky. Like aging wine or whisky, there is a minimum time period that the lump ore feed must be stored before it is reclaimed. Claim 1 states that the purpose of the storage period is to provide time to allow the release of internal stresses. In a conventional stockpile ore at the center of the stockpile is older than ore on the perimeter of the pile, and when the stockpile is used at least some of the ore on the perimeter is used first. In the invention, the ore is stored until it has aged at least one month before it is reclaimed, so that if the ore is saved as a conventional stockpile the ore on the perimeter would have to be aged at least one month, and ore in the center of the pile would be aged at least slightly longer, where the storage is in an open atmosphere. In contrast, PBK Engineering Ltd (1992) teaches holding stockpiles of ore for 4 days. The size of the stockpile depends on how much material the steel manufacturing plant wants to have on hand in the event that the mine can't produce. Stockpiling sometimes connotes creating a reserve, not a process of rotating inventory with a minimum time before use, and for that reason, claim 1 has been further amended deleting "stockpile". The stockpiling taught the PBK Engineering Ltd reference is a process of creating a reserve inventory, it is not a process of inventory rotation with a minimum time before use. With a stockpile, the order of use is typically at least partially "last in first out", because

the first material "in" is near the center of the stockpile. Once a sufficient reserve is established, the mine would no longer keep adding to the stockpile, as the stockpile serves as a hedge against the mine failing to deliver ore. The reserve need only be consumed if the mine shuts down for a long enough period that the steel making plant must use the reserve in order to keep running. Typically, the ore is used in a matter of days or hours. In any case, no minimum time before use is taught by the PBK Engineering Ltd reference. The Examiner has also cited a 1908 reference (The Metallurgy of Iron and Steel, Hill Publishing Co, NY). The 1908 reference teaches that ice in a canal two miles long prevents iron ore from being delivered for 3 months. The Examiner asserts that the stockpile would have to be at least 3 months old. The Examiner is only partially correct. Some material in the winter stockpile would have to be at 3 months old if the plant operates at the same capacity year around, but about a third of the stockpile may be consumed in the first month, and all of this material would be less than a month old. Therefore, 10 months of the year the material could be 1 month old. If the stockpile that is kept as a pure emergency reserve inventory (as the canal may not be iced over every year), then some of the material could be several years old, as it may be left over from previous years. The reference doesn't teach whether the material is reclaimed after a predetermined time, nor a minimum time before use. Like PBK Engineering Ltd, the referenced 1908 stockpile is a reserve to be used in case the mine or the ship cannot deliver. The 1908 reference teaches that the canal is only two miles long, so for most of the year the plant could get material that is only a few days old, depending on how long it takes to load and unload the ship. On page 21, the 1908 reference teaches that the ore is unloaded in 4.5 hours. On receipt of shipment the steel making plant can uses the ore in any order. The 1908 reference does not teach a minimum time before use. Applicants respectfully assert that currently amended Claim 1 is now in condition for allowance. The Examiner stated in the Interview Summary that an additional search will be required as Applicants are claiming a process that constitutes rotation of the inventory, where the process has a minimum time before use. To the Examiner's credit, between the PBK Engineering Ltd reference and the 1908 reference the subject matter appears to have already been comprehensively searched. Applicants had previously narrowed the subject field to sedimentary iron ore lump, and the issue of the minimum time before use has been addressed in prior office actions. The discovery by the Applicants of the beneficial results of

using an inventory rotation process of sedimentary iron ore lump, with a minimum time before use, as a process of minimizing fines has heretofore not been reported, otherwise Applicants would not have been so moved to file a patent application on the subject. The search to date covers a span of almost 100 years, and therefore the invention is prima facie not obvious in light of the breadth and comprehensiveness of the search and the uniqueness of Applicants' claim.

Claim 7 is currently amended to include the limitations of claim 1. Furthermore Applicants' claim 7 claims the upper temperature limit of 200 C. Villarreal-Trevino et al. teach in col. 3, line 20, that the temperature of the particles exiting the preheating device is 700° C. Villarreal-Trevino et al. (in claims 1,2), claim that the temperature of the particles exiting the preheating device is above 600 ° C. The Applicants' temperature limitation overcomes Villarreal-Trevino et al. Villarreal-Trevino et al. teach that the particles are combusted in the preheated device 12 (col. 4, lines 19-26) using a combination of air and natural gas (col. 4, line 27). The temperature of the material feeding into the furnace is set not by the temperature of the gases entering the hopper, but by the heat given off during combustion of the iron particles and the combustion gases. This temperature is approximately 700° C, so the Examiner is in error when she asserts that Villarreal-Trevino et al. could operate their pre-drier at any temperature. Furthermore, Applicants' pre-drier does not claim any combustion gases. The rejection is respectfully overcome.

Claim 2 is cancelled.

Claims 4-6 and 9 depend from independent claim 1, and derive novelty in part from their dependency. As to claim 4, Applicants disagree with the Examiner that a storage bin is equivalent to cyclones and rotary kilns. Both apparati keep the material therein in motion, while a storage bin maintains the material therein at rest. Furthermore, Applicants' and Meissner's exhaust gases are from a DRI process, while Stephens' exhaust gases are from oxidizing steps that burn the sulfur out

of the ore, therein generating sulfur dioxide (col. 2, line 67). Applicants' exhaust gases can be combined with cooling air 28, as necessary (page 8, line 25). Meissner teaches that the waste gases can indirectly be used to heat the reformer. Applicants claim in claim 4 that the waste gases are introduced to the storage bin. A couple of problems exist with the Examiner's argument. First and foremost, why would the Applicants want to add sulfur dioxide to the storage bin? This would merely lower the quality of the iron ore, and, combined with cooling air 28, create more emission gases that need to be cleaned up. Secondly, Meissner teaches that the waste gases can be used indirectly via a heat exchanger to heat the reformer. Meissner does not teach a process where waste gases, especially those laden with sulfur dioxide, ever come into direct contact with the iron ore, as shown in Stephens' steps 18 and 30. Meissner teaches away from the Examiner's combination, as it is obviously not useful. The rejections of claims 4 and 6 are therefore respectfully overcome. There is now a difference of 300° C between Applicants' temperature and Stephens' temperature of 600° C. Taken with its dependency from parent claim 1, and intervening dependent claim 4, claim 5 is believed to be allowable.

Claims 8 and 10 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Villarreal-Trevino et al. (US Pat. No. 6,395,056) in view of Meissner et al. (US Pat. No. 5,437,708), as applied to claim 7 above, and further in view of Becerra-Novoa et al (US patent 5,445,363). Examiner states it is obvious to insulate Villarreal-Trevino et al. piping.

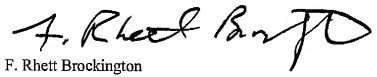
Claim 8 derives its novelty from claim 7. Applicants' contend that possibly Villarreal-Trevino et al.'s means for transporting the heated material is not insulated, as the heat of combustion given off by the natural gas may generate so much heat that Villarreal-Trevino et al. need to cool the pre-drier to keep the temperature down. Villarreal-Trevino doesn't appear to have any means, other than a hole, for transporting the heated feed materials. In any case, the citations do not read on insulation or a transporting means. Furthermore, Applicant's claim 8 is a dependent claim depending from claim 7, and has all the limitation of the parent claim.

With respect to claim 10, Examiner states that Villarreal-Trevino et al. (Figure 5, col. 4, line 20, to column 6, line 16) disclose a heat exchanger (44) and combustion chamber (16) between the means for recovering waste combusted off gas (42) and the feed material storage bin (12). Both the heat exchanger and the combustion chamber provide means for adjusting the temperature of the off-gas. Applicants' claim 10 is a dependent claim depending from claim 8 and independent claim 7, and has all the limitations of the intervening claim 8 and parent claim 7. Claim 10 derives its novelty from claims 7 and 8, and is equally patentable therewith.

Since the amendments to the claims do not add more claims than previously paid for, no additional fee is required for the claims.

In view of the foregoing amendment and these remarks, this Application is now believed to be in condition for allowance and such favorable action is respectfully requested on behalf of Applicants.

Respectfully submitted,



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